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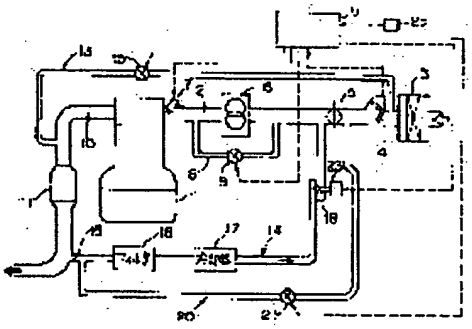
(54) EXHAUST GAS CIRCULATION DEVICE FOR ENGINE WITH SUPERCHARGER

(57)Abstract:

PURPOSE: To suppress generation of an agglutinated material due to fusion of condensed water by EGR gas cooling and solid component of such as carbon when cold exhaust gas (EGR gas) is refluxed upstream from a supercharger.



CONSTITUTION: A check valve 15, a filter 16 composed of catalyzer, a cooler 17, and a control valve 18 are interposed in an EGR passage 14 connected upstream from supercharger 6 in flow direction of gas in order. The EGR gas first passes through the filter 16 to become free of solid component, and is refluxed to an intake passage 2 (located upstream from the supercharger 6) after being cooled by the cooler 17 thereafter. The filter 16 is composed of the catalyzer, therefore carbon and the like stuck to the filter 16 is promoted in combustion by catalytic action, and the filter 16 acquires self-purification function.

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* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention equips an inhalation-of-air path with a supercharger, and relates to the exhaust gas reflux equipment of the supercharged engine which flows back to an inhalation-of-air path in a part of exhaust gas (EGR gas).
[0002]
[Description of the Prior Art] The technique which flows back the exhaust gas (EGR gas) taken out from the downstream of a catalytic converter to the upstream of a supercharger is indicated by JP,1-285651,A. According to this, there is an advantage that a supercharger can perform a lot of EGR(s) in the supercharge field which demonstrates the supercharge capacity.
[0003] Moreover, arranging a condensator in the EGR path through which the above-mentioned EGR gas passes, and cooling EGR gas with this condensator in this official report, is indicated. According to this, when the exhaust gas temperature especially in a heavy load operating range can be reduced and an engine compression ratio is formed into a high compression ratio with cold EGR gas (cold EGR), there is an advantage that the thermal damage on the exhaust air system components (especially catalytic converter) at the time of forming into high charge pressure charge pressure which a supercharger generates can be prevented.
[0004]
[Problem(s) to be Solved by the Invention] However, when a condensator is arranged in an EGR path, and the water of condensation generated in connection with EGR gas being cooled by this condensator, the carbon intermingled in EGR gas unite, an adhesion object is generated and the problem that the EGR gas containing this adhesion object will flow back to an inhalation-of-air path occurs. Of course, since this adhesion object enters into a supercharger when the above-mentioned adhesion object is thrown into an inhalation-of-air path, there is a possibility of spoiling the dependability of a supercharger.
[0005] Then, the purpose of this invention is to offer the exhaust gas reflux equipment of the supercharged engine which suppressed generating of the above-mentioned adhesion object which poses a problem, when a condensator is arranged in an EGR path.
[0006]
[Means for Solving the Problem] That the above-mentioned technical technical problem should be attained, if it is in this invention, the following configurations are adopted. Namely, the supercharger which supercharges by being arranged in an engine inhalation-of-air path and the catalytic converter which an engine flueway is arranged and purifies exhaust gas, It has the EGR path which flows back to an inhalation-of-air path in a part of exhaust gas which flows said flueway. Said EGR path The inlet-port edge is connected to the flueway of the downstream rather than said catalytic converter, and an outlet edge is connected to the inhalation-of-air path of the upstream rather than said supercharger. In this EGR path It has considered as the configuration in which the filter which removes in order the formed element in the EGR gas which flows this EGR path from the upstream towards the downstream, and the condensator which cools EGR gas are arranged.

[0007]
[Function] Since the above-mentioned filter is arranged in the upstream of the condensator arranged in the EGR path according to the above-mentioned configuration, the EGR gas which the carbon which EGR gas is the preceding paragraph story which flows into a condensator, and is intermingled in this EGR gas is removed, therefore does not contain formed elements, such as carbon, in a condensator will flow. For this reason, even if the water of condensation is generated by cooling EGR gas with a condensator, it becomes possible to suppress generating of the adhesion object generated by fusion of this water of condensation, carbon, etc.
[0008]
[Example] Below, it explains based on the drawing which attached the example of this invention.
[0009] In drawing 1 , a sign 1 is an engine and an air cleaner 3, the air flow meter 4, the throttle valve 5, the supercharger 6, and the fuel injection valve 7 are arranged in the inhalation-of-air path 2 in order towards the downstream from the upstream. It is mechanically driven with the output of an engine 1, the above-mentioned supercharger 6 being used as a mechanical supercharger.
[0010] The bypass path 8 which bypasses a supercharger 6 is attached to the above-mentioned inhalation-of-air path 2, a bypass valve 9 is infixed in this bypass path 8, and like known, when charge pressure becomes beyond a predetermined value, a bypass valve 9 is opened.
[0011] The catalytic converter 11 which contained the three way component catalyst in the middle is formed in the flueway 10 of an engine 1, and the silencer outside drawing is arranged in the down-stream edge of a flueway 10.
[0012] Between the above-mentioned inhalation-of-air path 2 and the flueway 10, the 1st secondary air passage 13 and EGR path 14 are prepared.
[0013] That inlet-port edge is connected to the inhalation-of-air path 2 of the upstream, and the inhalation-of-air path 2 across which it faced with the air flow meter 4 and the air cleaner 3 in more detail rather than an air flow meter 4, another side and an outlet edge are connected to the flueway 10 of the upstream rather than a catalytic converter 11, and, as for the secondary air passage 13 of the above 1st, the control valve 15 is infixed in that middle at this 1st secondary air passage 13.
[0014] The inlet-port edge is connected to the flueway 10 of the downstream rather than a catalytic converter 11, and another side and an outlet edge are connected to the inhalation-of-air path 2 of the upstream, and the inhalation-of-air path 2 across which it faced by the supercharger 6 and the throttle valve 5 in more detail for the above-mentioned EGR path 14 rather than the supercharger 6. The check valve 15, the filter 16, the condensator 17, and the control valve 18 are infixed in this EGR path 14 in order towards the downstream from the upstream.
[0015] While the above-mentioned check valve 15 permits that the exhaust gas passing through a flueway 10 flows into the EGR path 14, it prevents that the gas in the EGR path 14 flows backwards to a flueway 10.
[0016] The above-mentioned filter 16 consists of a three way component catalyst or an oxidation catalyst, and carries out the trap of the carbon contained in the exhaust gas (EGR gas) which passes through the EGR path 14, and the self-purification function which this adhering carbon is burned and is purified possesses it.
[0017] The 2nd secondary air passage 20 is attached to said engine 1. That inlet-port edge is connected to the inhalation-of-air path 2 of the downstream, and the inhalation-of-air path 2 across which it faced with the throttle valve 5 and the air flow meter 4 in more detail rather than an air flow meter 4, an outlet edge is connected to the EGR path 14 of the upstream rather than a filter 16, and, as for this 2nd secondary air passage 20, the control valve 21 is infixed in that middle at the 2nd secondary air passage 20.
[0018] In drawing 1 , Sign U is a control unit, and a control unit U consists of microcomputers and it possesses CPU, ROM, RAM, etc. like known. The various signals with which the signal with which an inhalation air content is expressed from an air flow meter 4 is inputted, and also an engine speed, an engine load, etc. are expressed from the sensor group 25 are inputted into a control unit U. On the other hand, various control signals are outputted to the actuator 23 grade for EGR control-valve 18 from a

control unit U.
[0019] The contents of the control performed by the control unit U are explained below.
if it limits to the Air Fuel Ratio Control heavy load field and explains -- a heavy load field -- a low rotation region -- setting -- for example, A/F= -- about 13 -- as -- an air-fuel ratio more rich than theoretical air fuel ratio is set up. On the other hand, in a high rotation region, an air-fuel ratio or theoretical air fuel ratio (lambda= 1) Lean [theoretical air fuel ratio] is set up. In addition, since the concrete Air Fuel Ratio Control approach is the same as usual, the detailed explanation is omitted.
[0020] If it limits to a heavy load field and control of the secondary air supplied to the upstream of the 1st secondary air control catalytic converter 11 is explained, supply of secondary air will stop in the low rotation region where a rich air-fuel ratio is set up, a control valve 15 being used as a close-by-pass-bulb-completely condition. On the other hand, in a heavy load quantity rotation region (the Lean air-fuel ratio or theoretical-air-fuel-ratio field), a control valve 15 is opened and supply of secondary air is performed to the upstream of a catalytic converter 11.
[0021] It becomes the factor which an unburnt component burns [factor] by the exhaust air system, and makes exhaust gas elevated-temperature-ize by the above-mentioned secondary air control in the low rotation region made rich [an air-fuel ratio] when the unburnt component is contained in exhaust gas and secondary air is supplied in this low rotation region. On the other hand, in the high rotation field to which an air-fuel ratio is made into theoretical air fuel ratio or the Lean air-fuel ratio, since there are few unburnt components in exhaust gas, it will contribute to secondary air doing so the operation which mainly cools exhaust gas, and raising the dependability of a catalytic converter 11.
[0022] The EGR control valve 18 is opened in an EGR control heavy load field. When this EGR valve 18 is opened, a part of exhaust gas passing through a flueway 10 will be incorporated at the EGR path 14, and when this EGR gas passes a filter 16 first, formed elements, such as carbon which is inherent in EGR gas, will be removed. Furthermore, EGR gas will flow back to the inhalation-of-air path 2, after being cooled by the condensator 17 (cold EGR).
[0023] thus, heavy load operation -- setting -- cold one -- even if a supercharger 6 generates high charge pressure when an engine 1 is a high compression ratio engine and/or in order to have performed EGR for example, it becomes possible to stop exhaust gas temperature low, and the thermal damage on exhaust air system components, especially a catalytic converter 11 can be prevented.
[0024] Moreover, since the filter 16 is arranged in the upstream rather than the condensator 17 as mentioned above (i.e., in order for EGR gas to have carried out the trap of the carbon in EGR gas etc. on the preceding paragraph story which passes a condensator 17), generation of the adhesion object which is a fusion object of the water of condensation, carbon, etc. which are produced when a condensator 17 cools EGR gas can be prevented.
[0025] Furthermore, since the filter 16 consists of catalysts, as for the carbon adhering to a filter 16 etc., the combustion will be promoted by the catalysis, and a filter 16 will possess a self-purification function.
[0026] In the 2nd secondary air control heavy load field (heavy load EGR field mentioned above), a control valve 21 is opened and supply of secondary air is performed to the EGR path 14 in the low rotation region where a rich air-fuel ratio is set up. On the other hand, in the heavy load quantity rotation region where the Lean air-fuel ratio or theoretical air fuel ratio is set up, a control valve 21 is closed and supply of the secondary air to the EGR path 14 stops.
[0027] that is , in the field make into a rich air-fuel ratio , although there be many unburnt components in exhaust gas relatively , since an engine speed be low rotation , there be few amounts of exhaust gas per unit time amount (there be also few amounts of the EGR gas which pass through the EGR path 14) , and even if it supply secondary air and promote combustion , such as carbon in a filter 16 , the rise of the EGR gas temperature accompanying this can be compensate with a condensator 17 . Therefore, coexistence with cold EGR can be aimed at, putting into practice removal of the carbon intermingled in EGR gas by carrying out secondary air supply in a low rotation field.
[0028] On the other hand, in the field made into theoretical air fuel ratio or the Lean air-fuel ratio, there are few amounts of the unburnt component in exhaust gas relatively. Therefore, it is lacking in the need

of daring supply secondary air and promoting combustion of the carbon in a filter 16 etc. When putting in another way and secondary air is supplied, the rise of EGR gas temperature is caused with activation of the catalysis in a filter 16. In addition, there are also many amounts of EGR gas per [to which this field passes through the EGR path 14 since an engine speed is high rotation] unit time amount, and it becomes difficult to absorb the rise of the EGR gas temperature accompanying secondary air supply with a condensator 17. that is, cold by suspending supply of secondary air in a heavy load quantity rotation region -- it becomes possible to secure EGR.

[0029] Furthermore, in this heavy load quantity rotation region, since supply of secondary air is performed to the upstream of a catalytic converter 11 and removal of the unburnt component in exhaust gas is performed by this catalytic converter 11 as mentioned above, the need for activation (supply of the secondary air using the inhalation-of-air path 20) of the catalysis in a filter 16 is still scarcer.

[0030] In addition, when the air-fuel ratio of this field (heavy load quantity rotation field) is set as the big Lean air-fuel ratio like A/F=22, you may make it supply secondary air to the upstream of a filter 16 using said secondary air control valve 21.

[0031] that is, since an unburnt component is hardly intermingled in exhaust gas when the Lean degree of an air-fuel ratio is raised, the secondary air supplied to the EGR path 20 will contribute to mainly reducing EGR gas temperature, and is cold -- it becomes possible to raise the effectiveness by EGR. Of course, since the secondary air supplied to the EGR path 20 is incorporated by the downstream rather than an air flow meter 4, and in order not to leak the secondary air supplied to the EGR path 14 to a flueway 10 by the above-mentioned check valve 15, Air Fuel Ratio Control is not affected with supply of this secondary air.

[0032] As mentioned above, although the example of this invention was explained, this invention includes the following modifications, without being limited to the above-mentioned example.

(1) A supercharger 6 may be a turbocharger which it is not restricted to a mechanical supercharger but is driven by exhaust air energy.

(2) Condensators 17 may be a water cooling type and air-cooled any.

[0033]

[Effect of the Invention] cold one which was cooled with the condensator according to this invention so that clearly from the above explanation -- the dependability of a supercharger is not spoiled in connection with being able to suppress generating of the adhesion object which poses a problem, when performing EGR, therefore performing cold EGR

[Translation done.]

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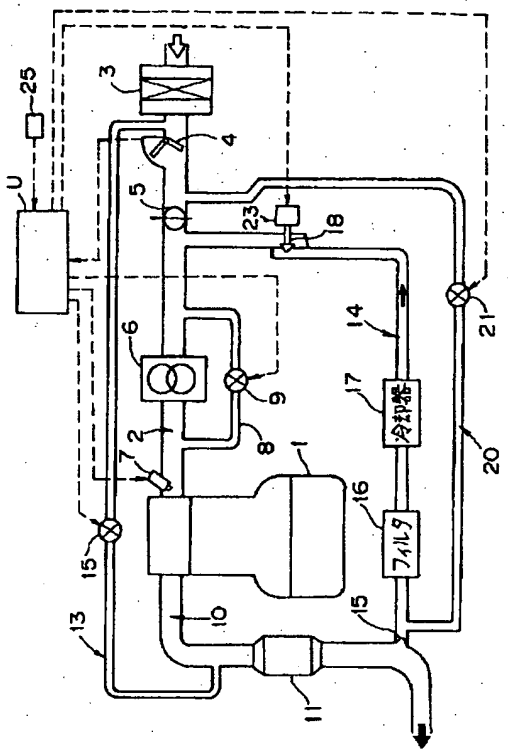
CLAIMS

[Claim(s)]
[Claim 1] The supercharger which supercharges by being arranged in an engine inhalation-of-air path, and the catalytic converter which is arranged in an engine flueway and purifies exhaust gas, It has the EGR path which flows back to an inhalation-of-air path in a part of exhaust gas which flows said flueway. Said EGR path The inlet-port edge is connected to the flueway of the downstream rather than said catalytic converter, and an outlet edge is connected to the inhalation-of-air path of the upstream rather than said supercharger. In this EGR path Exhaust gas reflux equipment of the supercharged engine characterized by what the filter which removes in order the formed element in the EGR gas which flows this EGR path from the upstream towards the downstream, and the condensator which cools EGR gas are arranged for.
[Claim 2] It is exhaust gas reflux equipment of the supercharged engine which consists of catalysts for which said filter purifies EGR gas in claim 1, and is characterized by having the inhalation-of-air path of the downstream, and the secondary air passage connected to the EGR path of the upstream rather than said filter rather than the inspired-air-volume detector further arranged in the upper edge of said inhalation-of-air path, and this inspired-air-volume detector.
[Claim 3] The EGR control valve further interposed in said EGR path in claim 2, The secondary air control valve interposed in said secondary air passage, and a load detection means to detect an engine load, The signal from the rotational frequency detection equipment which detects an engine speed, and said load detection means and a rotational frequency detection means is received. While controlling the air-fuel ratio of the gaseous mixture which an engine inhales by the heavy load low rotation field to become a rich air-fuel ratio from theoretical air fuel ratio An Air Fuel Ratio Control means to control by the heavy load quantity rotation field to become the Lean air-fuel ratio from theoretical air fuel ratio or theoretical air fuel ratio, The EGR control means which said EGR control valve is opened [control means] and makes a part of exhaust gas flow back to an inhalation-of-air path when the signal from said load detection means is received and an engine load is in a heavy load field, Receive the signal from said load detection means and an engine-speed detection means, and said secondary air control valve is opened in the heavy load low rotation field in which said rich air-fuel ratio is set up. Exhaust gas reflux equipment of the supercharged engine characterized by having the secondary air control means which closes said secondary air control valve in the heavy load quantity rotation field in which said theoretical air fuel ratio or said Lean air-fuel ratio is set up.

[Translation done.]

Drawing selection Representative drawing



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